State of Wisconsin/Department of Transportation

RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: Dec 31, 2002

Program: SPR-0010(36) FFY99	**Part: II Research and Development**
Project Title: Rehabilitation Techniques for Concrete Bridges	**Project ID:** 0092-01-06
Administrative Contact: Nina McLawhorn	**Sponsor:**
WisDOT Technical Contact: Error! Bookmark not defined.	**Approved Starting Date:** Jan 18, 2001
Approved by COR/Steering Committee: $124,968.00	**Approved Ending Date:** Sep 18, 2003
Project Investigator (agency & contact): Habib Tabatabai: UW-Milwaukee	

Description: This study will be conducted over 18 months, and will be completed in five (5) phases.
Task A: Literature Search
Task B: Testing and Software Development Plan
Task C: Laboratory Testing & Software Development
Task D: Field Demonstration and Evaluation
Task E: Report

Background:
Research Project Description
Concrete bridges in Wisconsin and elsewhere have shown severe signs of deterioration due to aging and other detrimental factors. Considering the enormous cost and effort required to remedy bridge deficiencies, it is crucial that a concerted effort be made to develop and implement practical, effective and economical methods and guidelines for the repair and rehabilitation of bridges. These methods should include effective preventative maintenance measures to reduce the impact and severity of long-term deterioration. This proposal addresses repair and rehabilitation techniques and guidelines for reinforced and prestressed concrete bridges in the state of Wisconsin.

RFP Statement
With the aging of Wisconsin's concrete bridges, increasing evidence of partial or extended bridge deterioration is experienced throughout the state. Problems such as failure of expansion joints, deterioration of concrete at the vicinity of joints and abutments, corrosion of reinforcing and prestressing steel, damage to overhead beams/girders due to truck impact, and other effects exist and need to be corrected on a daily basis. It would be beneficial to the WISDOT maintenance personnel to develop guidelines and procedures for implementing cost effective and reliable rehabilitation techniques to bring Wisconsin's concrete bridges to acceptable service conditions. Performing a study to evaluate various rehabilitation methods developed and implemented elsewhere as well as further development of additional techniques to address specific problems related to Wisconsin's concrete bridges could enhance the economy and safe use of our bridges in the state.

Total Study Budget	Current FFY Budget	Expenditures for Current Quarter	Total Expenditures to Date	Percent Complete
$124,968.00	**$41,656.00**	$3,249.83	**$120,932.83**	**83 (%)**

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Progress This Quarter:
(Includes project committee mtgs, work plan status, contract status, significant progress, etc.)

An evaluation of repair procedures and materials were made and a repair plan was finalized. All beam-ends that were scheduled for repair were first cleaned. They were all previously subjected to over six months of accelerated corrosion. A set of measurements were taken before repairs. The following beam treatments/repairs were performed:

- Sealer (applied on one beam end that was previously untreated)
- Coating (on one beam end that was previously untreated)
- Polymer coating without fiber (on one beam end that was previously untreated)
- FRP wrap (on one beam end that was previously untreated)
- Patch repair (on one beam end that was previously untreated)

A previously untreated beam end was left untreated. In the patch repair beam, chloride measurements were first taken. Then, a length of about 18 in. of concrete was first removed in the bottom flange area on both sides of the beam end (this included exposing the first line of strands). Although chloride readings were elevated, the corrosion had penetrated only about 2 inches into the beam end. The exposed concrete and steel surfaces were cleaned and coated before a commercial patch material was applied in accordance with manufacturers' recommendations. In these repairs, chloride extraction methods were not employed, as previous research in this area was not encouraging.

Since corrosion had not penetrated deeper into the beam, it was decided to enlarge the salt-water splash zone by extending the affected areas on the sides of the beams. This would increase the surface exposure to salt-water. The accelerated corrosion setup (including piping) was modified to accommodate this change. The accelerated corrosion process was then restarted.

Work on the software continued. We are using the CLIPS expert system software in conjunction with visual basic interface.

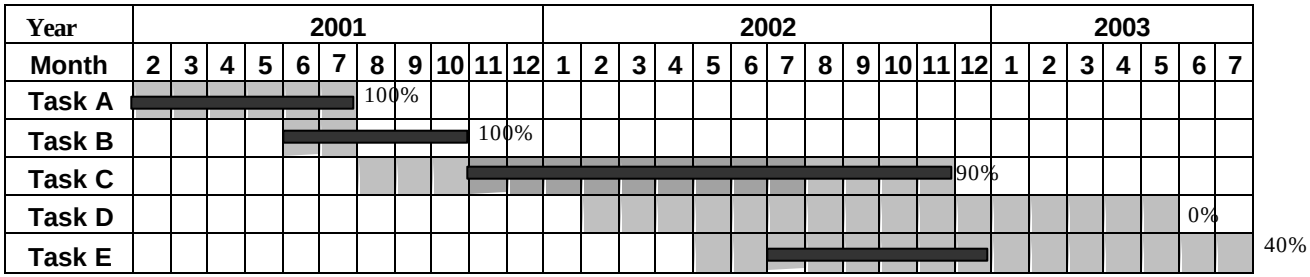
Work Next Quarter:

Monitoring of test beams including corrosion rate measurements, displacements, half-cell potential (were applicable) will continue. A first draft of the expert program will be completed. Planning for field demonstration will be initiated.

Circumstances affecting progress/budget:

During the removal of concrete for the patch repair of one beam, it was noted that the corrosion of strand had progressed to a depth of only about 2 inches (from beam end) despite relatively high chloride concentration and six months of accelerated corrosion. It was decided to enlarge the saltwater splash area to increase strand exposure. However, we are proposing that the project duration be extended by another six months (without cost increase) to increase corrosion, and to be able to make a more meaningful comparison of the effectiveness of different treatments. The software and a preliminary report will be submitted at the end of the current contract period, but the final report would be submitted six months later after the additional exposure period, and will incorporate the final data. We would very much appreciate a favorable consideration of this request.

Gantt Chart:



Planned (Original)

Revised Schedule for Revised Test Plan

Work Performed

Estimated Total Completion 83%

Note: Gantt chart shown in State Fiscal Year Quarters